Leica TPS110C Series

User Manual TC(R)110C

English
Version 2.1

Leica Geosystems

Congratulations on your purchase of a new Leica Geosystems Total Station.

This manual contains important safety directions (*refer to chapter "Safety directions"*) as well as instructions for setting up the product and operating it.

Read carefully through the User Manual before you switch on the product.

The type and the serial number of your instrument are indicated on the label inside the battery compartment.
Write the type and serial number of your instrument in the space provided below, and always quote this **information** when you need to contact your **agency** or **service workshop**.

Type: _____ Serial no.: _____

The symbols used in this User Manual have the following meanings:

DANGER:
Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING:
Indicates a potentially hazardous situation or an unintended use which, if not avoided, could result in death or serious injury.

CAUTION:
Indicates a potentially hazardous situation or an unintended use which, if not avoided, may result in minor or moderate injury and / or appreciable material, financial and environmental damage.

Important paragraphs which must be adhered to in practice as they enable the product to be used in a technically correct and efficient manner.

Introduction 9
Operating concept, Keyboard 13
Measuring preparation 22
Measuring 32
Programs 40
Menu 42
Checking and Adjusting 54
Care and Storage 65
Messages and Warnings 68
Accessories 71
Safety Directions 72
Technical Data 92
Index 97

Area of Applicability 8

Introduction 9
Special Features 9
Important Components 10
Technical Terms and Abbreviations 11

Operating concept, Keyboard 13
Focus, Buttons 15
Symbols 16
Menu tree 17
User Entries 20

Measuring preparation 22
Unpacking 22
Batteries 23
Inserting / Replacing Battery 24
External power supply for total station 26
Setting Up the Tripod 27
Centring with Laser Plummet, Coarse Level-Up 28
Accurate Levelling-Up with Electronic Level 29
Laser Intensity 30
Hints for Positioning 30
Centring with Shifting Tribrach 31

Measuring 32
Displayed Data 32
Distance measurement 33
Coordinate measurement 36
EDM Change (TCR only) 37
Laserpointer (TCR only) 37
Angle measurement 38
Set Hz-angle 38
Set Hz-angle direction 38
V-angle setting 39

Programs 40
Tie Distance 40
Construction 41
As built check 41

Menu 42
Settings 42
System Settings 43
EDM Settings 46

Angle Settings 48
Unit Settings 49
System Information 50
Communication Parameters 53

Checking and Adjusting 54
Electronically 54
Line-Of-Sight Error (Hz-Collim.) 54
Vertical Index Error (V-Index) 55
Determining Instrument Errors 55
Determining The Line-Of-Sight Error (c) 57
Determining V-Index 58
Mechanical 60
Tripod 60
Circular Level 60
Circular Level on the Tribrach 60
Laser Plummet 61
Reflectorless EDM 62

Care and Storage 65
Transport 65
In the Field 65
Inside Vehicle 66
Shipping 66
Storage 66
Cleaning 67

Messages and Warnings 68

Accessories 71

Safety Directions 72
Intended Use of Instrument 72
Permitted Uses 72
Adverse Uses 72
Limits of Use 73
Responsibilities 74
Laser Classification 81
Integrated EDM (Infrared Laser) 81
Integrated EDM (Visible Laser) 83
Laser Plummet 85
Electromagnetic Compatibility (EMC) 88
FCC Statement (Applicable in U.S.) 90

Technical Data 92

Index 97

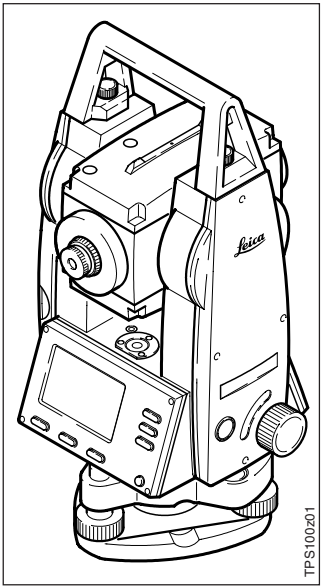
Area of Applicability

This User Manual is valid for all instruments in the TPS110℃ Series.
TC Instruments are equipped with an invisible infrared EDM. The TCR Instruments are also equipped with a visible red laser for reflectorless measuring and a serial interface.
Sections only valid for TCR instruments are marked accordingly.

The Leica Geosystems TC(R)110© is a high-quality electronic total station designed for the construction site.
Its innovative technology makes the daily surveying jobs easier.

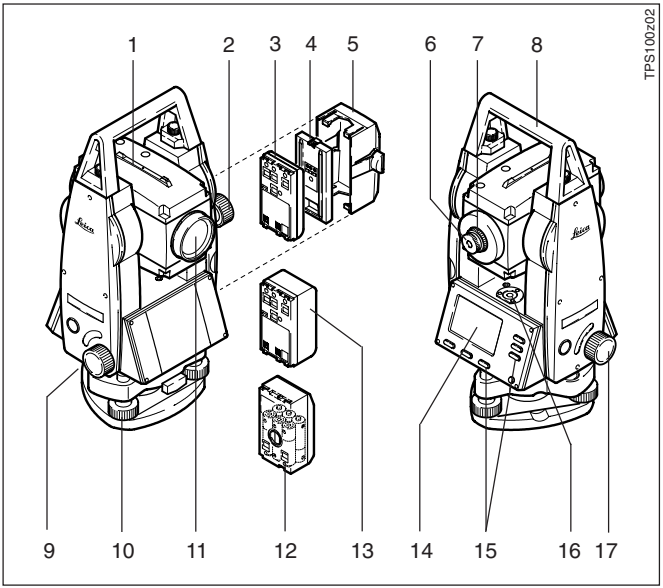
The instrument is ideally suited for simple construction surveys.

The operation of the instrument's functions can be learned easily in a short space of time.

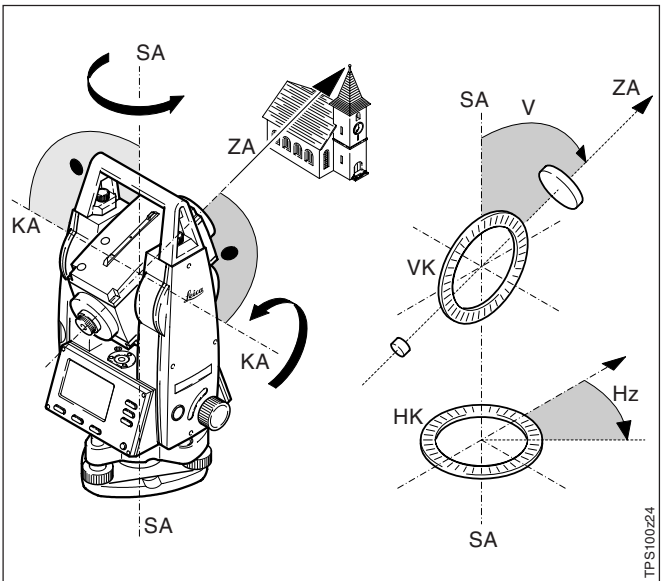


Special Features

- Easy and quickly to learn !
- Interactive keys; with large and clear LCD.
- Small, light-weight and easy-to-use.
- Measurements without reflector with the integrated visible laser beam (TCR instruments).
- Continuous drives for horizontal and vertical angles (tangent screws).
- Laser plummet and electronic level for quick and easy set up.
- Variable battery concept.



1 Alignment sight
2 Vertical drive
3 Battery GEB111
4 Battery spacer for GEB111
5 Battery holder for GEB111/ GEB121/GAD39
6 Eyepiece
7 Telescope focusing ring
8 Detachable carrying handle with mounting screws
9 Serial interface RS232 (TCR110℃)
10 Foot screws
11 Objective with integrated Electro-optic Distance Meter (EDM)
12 Battery adapter GAD39 for 6 single cells (optional)
13 Battery GEB121 (optional)
14 Display
15 Keypad
16 Circular level
17 Horizontal drive



ZA = Line of sight / collimation axis
Telescope axis = line from the reticle to the centre of the objective.

SA = Standing axis
Vertical rotation axis of the total station.

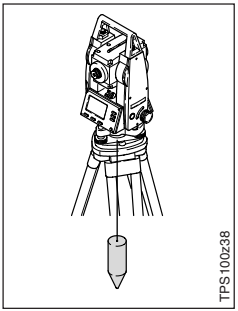
KA = Tilting axis
Horizontal rotation axis of the telescope (Trunion axis).

V = Vertical angle / zenith angle

VK = Vertical circle
With graduated scale for reading the V-angle.

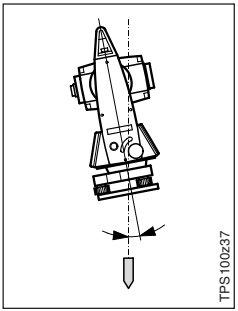
Hz = Horizontal angle

HK = Horizontal circle
With graduated scale for reading the Hz-angle.



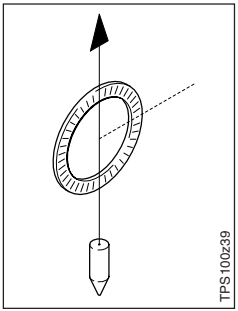
Plumb line / Compensator

Direction of gravity. The compensator defines the plumb line within the instrument.



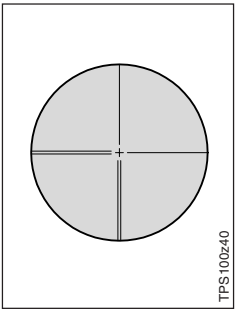
Standing axis Inclination

Angle between plumb line and standing axis.



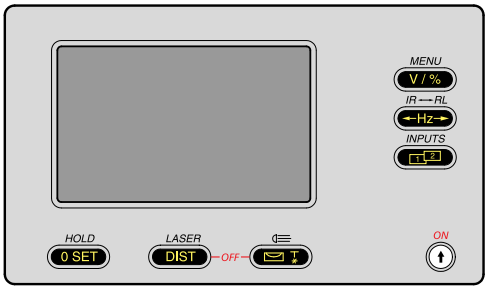
Zenith

Point on the plumb line above the observer.



Reticle

Glass plate within the telescope engraved with the cross hair lines.



ON/OFF keys

ON — Switches instrument ON

DIST – OFF – T — Switches instrument OFF by pressing both keys simultaneously

Function keys

Display dependent keys: Used either as fixed keys or as buttons.

0 SET — Sets Hz-angle to 0

DIST — Measures distance and angles

T — Switches electronic level and laser plummet ON/OFF

Fixed keys

V / % — Sets the "0"-orientation of the V-angle

Hz — Sets Hz-angle direction

Changes display (scroll)

Shift key: Switches to the second key level (*HOLD*, *LASER*, , *MENU*, *IR↔RL*, *INPUTS*).

Key combinations

HOLD + 0 SET
Holds Hz-angle

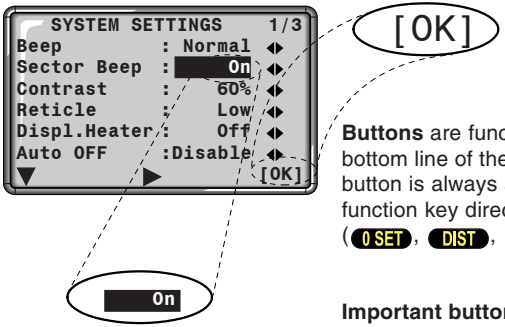
LASER + DIST
Switches visible laser beam ON/OFF (TCR only).

+
Switches the display illumination ON/OFF and activates the display heating (if the instrument temperature is less than -5°C).

MENU + V / %
Calls to the menu functions (Instrument settings, System information and calibration)

IR↔RL + ←Hz→
Change between the two EDM types IR (infrared) and RL (reflectorless). (TCR only)

INPUTS +
Calls the inputs display for reflector and instrument height)



The **focus** indicates the currently processed field.The focus is controlled with buttons.

Buttons are functions in the bottom line of the display. A button is always assigned to a function key directly below it (0 SET , DIST ,).

Important buttons

▼ Moves the focus downwards. Reaching the bottom field the focus jumps to the top field (wrap around).

▶ Selects a setting or starts the edit mode (if the field allows user entries). Refer to chapter *"User Entries"*

[OK] Confirms settings; starts menu command

[EXIT] Leaves the display

[MEAS] Button for measurements in the applications

Buttons and the focus can be found in the menu and the inputs display. Find more and detailed information about buttons and focus in the relevant sections.

1/3, 2/3, 3/3
1/2, 2/2

Indicates that several pages are available which can be selected with . The last page is followed by the first.

.. /.. Current page / total number of pages

I, II Indicates telescope face I or II

Indicates that Hz is set to "left side angle measurement" (anti-clockwise).

Compensator status

Compensator switched on (2 axes).

Compensator switched off.

Status symbol "EDM type"

IR Infrared EDM (invisible) for measuring with prisms and reflective targets.

RL Reflectorless EDM (visible) for measuring without prisms.

Status Symbol "Shift"

was pressed.

Status symbol "Battery capacity"

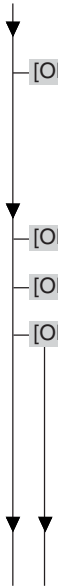
The battery symbol indicates the level of the remaining battery capacity (75% full shown in the example).

◀ ▶ A double arrow indicates choice fields.
The desired parameter can be selected using the ▶ button.
Selection fields can be left with the ▼ button.

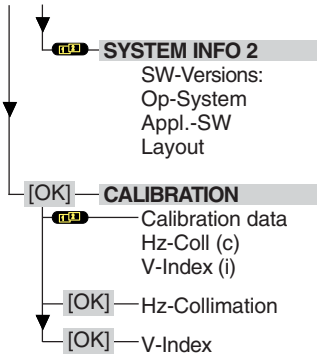
Menu tree

MENU (↑ V / %)

[OK] — **SYSTEM**		***SYSTEM SETTINGS***
	Beep	Set beep (Off/Normal/Loud)
	Sector Beep	Set sector beep (Off/On)
	Contrast	Set display contrast (0%-100%)
	Reticle	Reticle illumination (Low/Medium/High)
	Displ.Heater	Display heater (On/Off)
	Auto OFF	Auto OFF (Enable/Disable/Sleep)
EDM		***EDM SETTINGS***
	Laserpointer	Visible laser beam On/Off
	EDM Mode	Select EDM mode (IR-Standard/IR-Track/IR-Tape/RL-Standard/RL-Track)
	Prism Type	Select prism type (Mini/Round/Tape/RL/User)
	Prism Const.	Entry of user specific prism constant (User)
ANGLE / UNITS		***ANGLE / UNIT SETTINGS***
	Tilt Corr.	Tilt compensation On/Off
	Hz-Collim.	Hz-collimation (line of sight error) On/Off
	Angle Res.	Select angle resolution
	Angle	Select angle unit (° ' " / gon / 360° decimal / mil)
	Distance	Select distance unit (meter / US feet / INT feet / US feet-inch-1/8 inch)



[OK] — **COMMUNICATION**		***COMMUNICATION SETTINGS***
	Baudrate	Data Transfer Speed 2400 / 4800 / 9600 / 19200 bits/second
	Databits	7 or 8
	Parity	Even / Odd / None
	Endmark	CR / CRLF
	Stopbits	1
[OK] — **TIE DISTANCE**		***APPLICATION***
[OK] — **CONSTRUCTION**		***APPLICATION***
[OK] — **SYSTEM INFO 1**		***SYSTEM INFORMATION 1 (DISPLAY ONLY)***
	Tilt Corr.	Tilt compensation
	Hz-Collim.	Hz-Collimation (line of sight error)
	Hz-Direction	Hz-angle direction
	Battery	Battery capacity
	Instr. Temp.	Instrument temperature
	Displ.Heater	Display heater



SYSTEM INFORMATION 2 (DISPLAY ONLY)

Operating System
Application software
User displays

Determining instrument errors

Indication of calibration data
Hz-Collimation (c)
V-Index (i)

Determining Hz-Collimation

Determining V-Index

User entry fields are characterized by the focus.

- Input fields: Enter/Edit data (e.g. reflector height)
- Choice fields: Selection out of a predefined choice list (e.g. units). A double arrow ◀▶ indicates a choice field.

Character set

The vertical character bar contains the following characters:

" + " (ASCII 43)
" - " (ASCII 45)
" 0 - 9 " (ASCII 48 - 57)

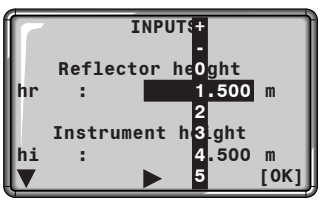
Input fields

Example: Inputs display

INPUTS (↑ + F1 F2)
Opens the Inputs display

▼ 1. Position focus on desired input field.

▶ 2. Start Edit mode: The vertical character bar is positioned left justified.



▼ 3. Select the desired character.

▶ 4. Confirm selected character: The vertical character bar moves to right.

5. Repeat steps 3 and 4 if necessary.

[OK] 6. Confirm input: The vertical character bar is being closed, the focus positions on the next input field.

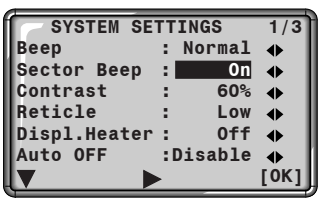
[OK] 7. Leaves the display.

Choice fields

Example: System settings

MENU (↑ + V/%)

Opens the MENU display
[OK] Selects the configuration



1 2 Change display

▼ 1. Position focus on desired choice field.

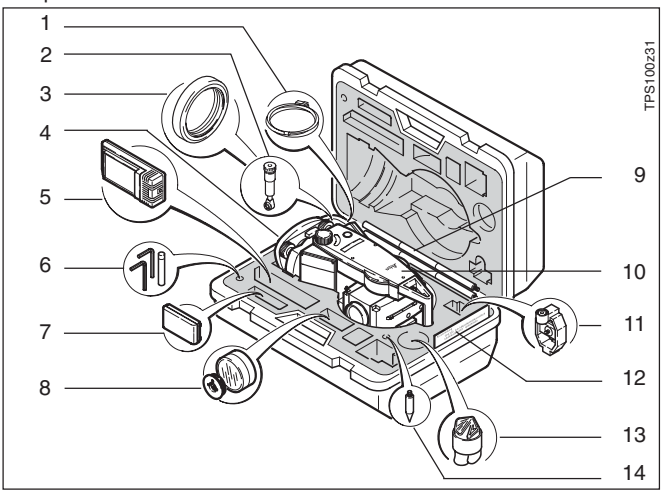
▶ 2. Select setting.

▼ 3. Confirm setting: The focus positions on the next choice field.

[OK] 4. Leaves the display.

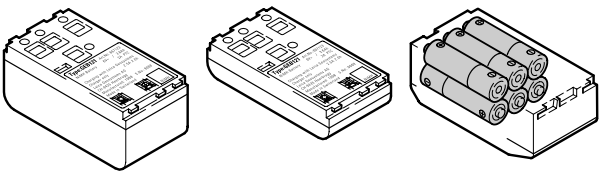
Unpacking

Remove TC(R)110℃ from transport case and check for completeness:



1 Data cable*
2 Diagonal eyepiece or eyepiece for steep angles*
3 Counterweight for eyepiece for steep angles*
4 Removable tribrach GDF101 / shiftable tribrach GUS75*
5 Battery charger and accessories*
6 Allen key (2x)
Adjusting pins (2x)
7 Spare battery GEB111*
8 Sun filter / plug adaptor tribrach*
9 Mini prism rod*
10 Total station (incl. battery)
11 Mini prism + holder*
12 User Manual / Short Instructions / Mini target plate (only for TCR instruments)
13 Protective cover / Lens hood
14 Tip for mini prism*

*) optional



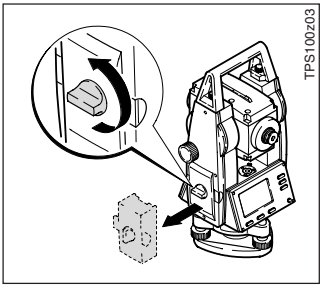
GEB121 GEB111 Individual cells in the battery adapter GAD39

Your Leica Geosystems instrument is operated with rechargable plug-in batteries. The Basic battery (GEB111) or the Pro battery (GEB121) is recommended for TPS110© Series instruments. As an option, six individual cells can be used with the appropriate battery adapter GAD39.

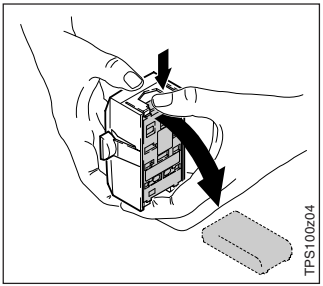
Six individual cells (1.5 V each) produce a voltage of 9 Volts. The battery indicator in the display is designed for a voltage of 6 Volts (GEB111/GEB121). For this reason the charge state of individual cells is not indicated correctly. The battery adapter with individual cells should therefore be used as a backup.

The advantage of individual cells is the low self-discharge rate - even over longer periods of time.

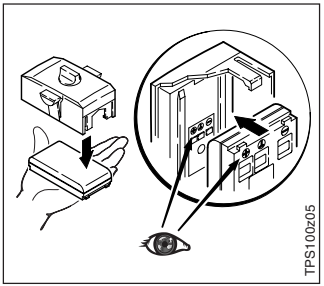
Use the Leica Geosystems batteries, chargers and accessories or accessories recommended by Leica Geosystems to ensure the correct functionality of the instrument.



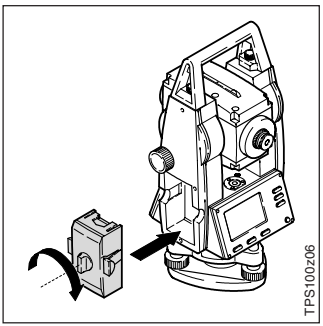
1. Remove battery holder.



2. Remove battery and replace.



3. Insert battery into battery holder.



4. Insert battery holder into instrument.

Insert battery correctly (note pole markings on the inside of the battery cover). Check and insert battery holder true to side into the housing.

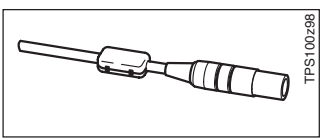
- For type of battery see section *"Technical Data"*.

If the battery GEB121 or the battery adapter GAD39 for six individual cells is used, the spacer for the GEB111 must be removed from the battery holder prior to inserting the battery.

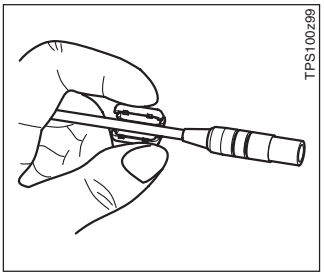
External power supply for total station

To meet the conditions stipulated for electromagnetic acceptability when powering the TCR110© from an external source, the supply cable used must be equipped with a ferrite core.

The Lemo plug with the ferrite core always has to be attached at the instrument side.

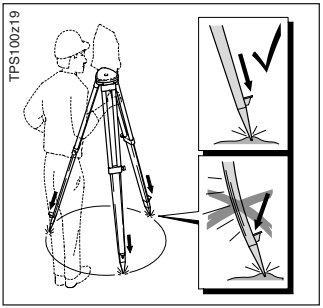


The cables supplied along with your instrument include a ferrite core as standard.
If you are using older cables without ferrite core, it's necessary to attach ferrite cores to the cable.
If you need additional ferrite cores, please contact your local Leica Geosystems agency. The spare-part number of the ferrite core is 703 707.

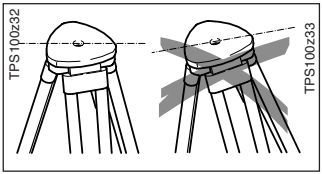


For assembling open up one ferrite core and clip it around the supply cable, about 2cm away from the Lemo plug, before using the supply cable for the first time together with a TCR110© instrument.

Setting Up the Tripod

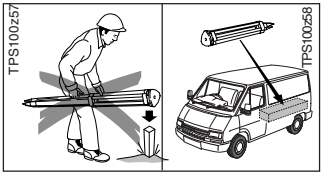


1. Loosen the clamping screws on the tripod legs, pull out to the required length and tighten the screws.
2. In order to guarantee a firm foothold sufficiently press the tripod legs into the ground.



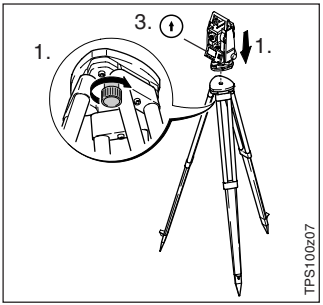
When setting up the tripod pay attention to a horizontal position of the tripod plate.

Heavy inclinations of the tripod plate must be corrected with the tribrach footscrews.

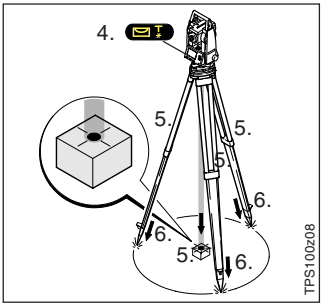


Careful handling of tripod

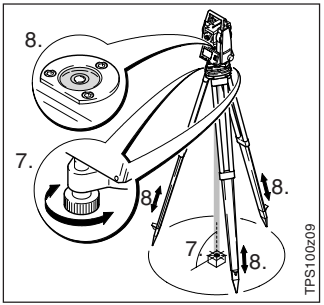
- Check all screws and bolts for correct fit.
- During transport always use the cover supplied.
- Use the tripod only for surveying tasks.



1. Place the instrument onto the tripod head.
   Tighten central fixing screw of tripod slightly.
2. Turn footscrews of tribrach into its centre position.
3. Switch on the instrument with ⏻.



4. Switch on laser plummet with . The electronic level appears in the display.
5. Position tripod legs so that the laser beam is aimed to the ground point.
6. Firmly press in tripod legs.

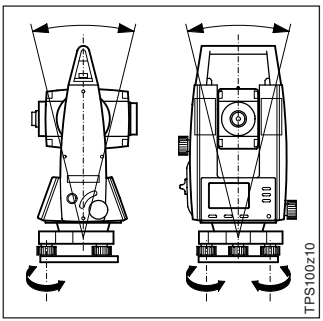


7. Turn the footscrews of the tribrach to centre the laser beam exactly over the ground point.
8. Move the tripod legs to centre the circular level. The instrument is now roughly levelled-up.

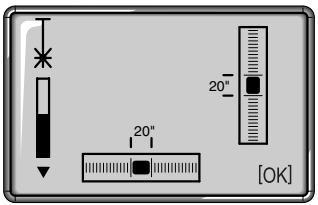
Accurate Levelling-Up with Electronic Level

1. Switch on electronic level with . In the case of insuffient levelling-up an inclined level symbol appears.

2. Center the electronic level by turning the footscrews.



If the electronic level is centered the instrument is levelled-up.

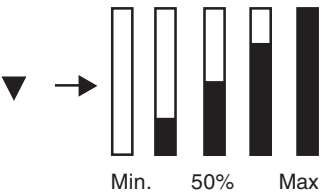


3. Check centring with the laser plummet and re-centre if necessary.

4. Switch off the electronic level and the laser plummet with [OK].

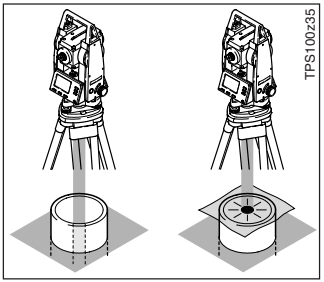
Changing the laser intensity

External influences and the surface conditions may require the adjustment of the intensity of the laser. The intensity of the laser plummet can be adjusted in 25% steps as required.



The indicated laser intensity is set, and the function terminated, with the [OK] button .

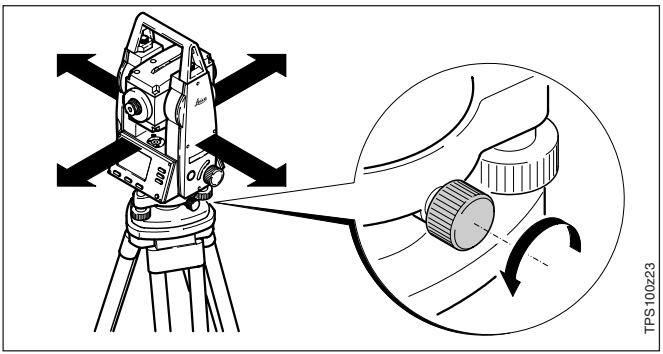
Laser plummet and electronic level are activated together with .



Positioning over pipes or depressions

In some circumstances, the laser spot is not visible (e.g. over pipes). In this case, the laser spot can be made visible by placing a sheet of transparent material over the end of the pipe.

Centring with Shifting Tribrach



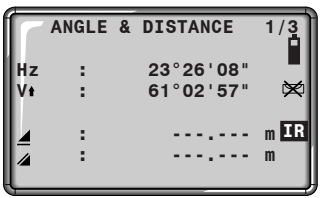
If the instrument is equipped with a shifting tribrach it can be aligned to the ground point by slight shifting.

1. Loosen screw.
2. Shift instrument.
3. Fix instrument by turning screw.

Displayed Data

After switching on (↑) and setting up correctly, (refer to chapter *"Measuring preparation"*) the total station is immediately ready for measuring.

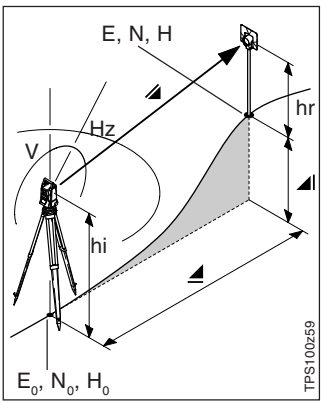
Example of a possible measuring display:



Changes to displays with additional data.

In measuring mode all keys are active.

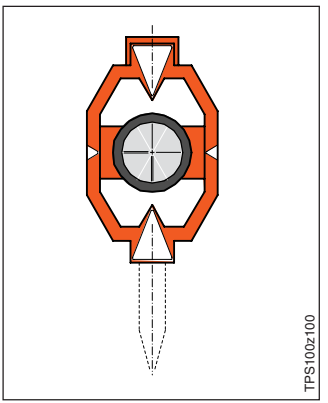
Explanation of displayed data



Hz	Horizontal angle
V	Vertical angle
◢	Slope distance
▬	Horizontal distance
◢|	Height difference
E	Easting of target point
N	Northing of target point
H	Height of target point
hr	Reflector height above ground
hi	Instrument height above ground
E0	Station coordinate (Easting)
N0	Station coordinate (Northing)
H0	Station height

Pointing

Centre cross hairs of the telescope to the middle of the prism.



Distance measurement

DIST Triggers a distance measurement and shows this on the display. The displayed distance remains valid until it is replaced by a new distance measurement.
Angles are displayed independently of the distance measurement.

Tracking mode

If the tracking mode is active (refer to chapter *"EDM Settings"*) the distance is triggered continuously after DIST.

DIST — Stops the tracking mode.

1 2 — Changes to displays with additional data (e.g. Height difference or Coordinates)

A laser distancer (EDM) is incorporated into the instruments of the TPS110© series.

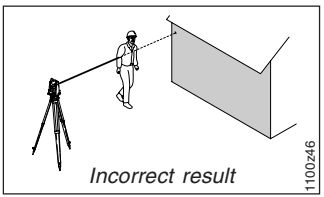
In all versions, the distance can be determined by using an invisible infrared beam which emerges coaxially from the telescope objective.

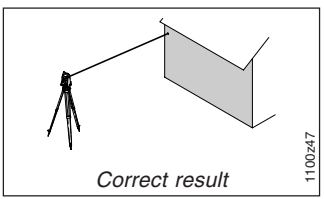
Measurements to strongly reflecting targets such as to traffic lights in infrared mode without prism should be avoided. The measured distances may be wrong or inaccurate.

For applications without reflector, the TCR-version also use **a visible red laser beam** which emerges in the same manner.

When a distance measurement is triggered, the EDM measures to the object which is in the beam path at that moment.

If e.g. people, cars, animals, swaying branches, etc. cross the laser beam while a measurement is being taken, a fraction of the laser beam is reflected and may lead to incorrect distance values. Avoid interrupting the measuring beam while taking reflectorless measurements or measurements using reflective foils. Measurements to prism reflectors are only critical if an object crosses the measuring beam at a distance of 0 to 30m and the distance to be measured is more than 300m. In practice, because the measuring time is very short, the user can always find a way of avoiding these critical situations.





Reflectorless

Be sure that the laser beam is not reflected by anything close to the line of sight (e.g. highly reflective objects).

When a distance measurement is triggered, the EDM measures to the object which is in the beam path at that moment. In case of temporary obstruction (e.g. a passing vehicle, heavy rain, fog or snow) the EDM may measure to the obstruction.

When measuring longer distances, any divergence of the red laser beam from the line of sight might lead to less accurate measurements. This is because the laser beam might not be reflected from the point at which the crosshairs are pointing.

Therefore, it is recommended to verify that the R-laser is well collimated with the telescope line of sight *(refer to the chapter "Checking and adjusting").*

Do not measure with two instruments to the same target simultaneously.

Red laser to prisms

WARNING:
Due to laser safety regulations and measuring accuracy, using the visible red laser (RL) is only allowed to prisms that are more than 1000 m (3300 ft) away.

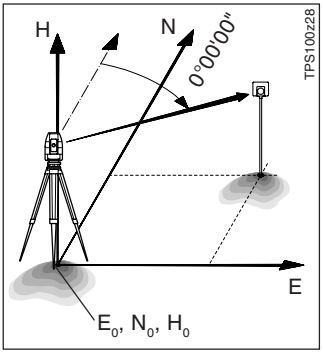
Accurate measurements to prisms should be made with the standard program (Infrared mode).

Red laser to reflector tape

The visible red laser beam can be used to measure to reflective foils, also. To guarantee the accuracy the red laser beam must be perpendicular to the reflector tape and it must be well adjusted *(refer to the chapter "Checking and adjusting").*

Make sure the additive constant belongs to the selected target (reflector).

The coordinates of the target point (E, N) always refer to the instrument station as origin of the coordinate system. The northing is defined through the 0° horizontal angle, the easting through the 90° horizontal angle.



EDM Change (TCR only)

IR↔RL (+ Hz)

Change between the two EDM types IR (Infrared) and RL (Reflectorless) as listed below. New setting is displayed for about one second and then set.

IR↔RL	
IR-Standard	RL-Standard
IR-Track	RL-Track
IR-Tape	RL-Standard

IR: Infrared: invisible, Distance measurements with prisms and tapes.

RL: Visible laser: Distance measurements without prisms up to 80m.

Find more information in section *"EDM Settings"*.

Laserpointer (TCR only)

LASER (+ DIST)

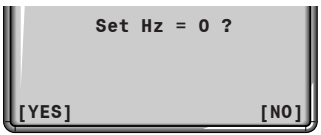
Switches on or off the visible laser beam for illuminating the target point. The new setting is displayed for approx. one second and then set.

Set Hz-angle to 0°00'00"

1. Aim on orientation point.

0 SET

2. The following confirmation message is shown:



[YES] 3a: Set Hz-angle to 0. Back to measuring mode automatically.

[NO] 3b: Back to measuring mode automatically without change.

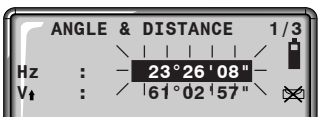
Set Hz-angle

Set any Hz-angle

1. Turn telescope to the desired Hz-angle.

HOLD

2. Hold indicated Hz-angle. The Hz-angle in the display starts flashing.



3. Aim on orientation point.

HOLD

4. ↑ 0 SET

5. Set Hz-angle. The Hz-angle stops flashing.

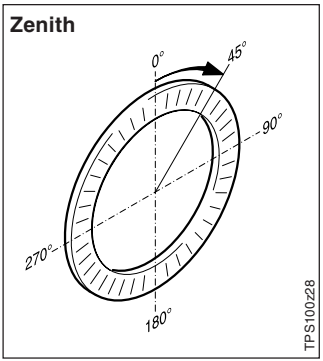
Set Hz-angle direction

←Hz→ Switch between "Right angle measurement" (= clockwise) and "Left angle measurement" (= anticlockwise).

Indicates that Hz is set to "left angle measurement" (anticlockwise).

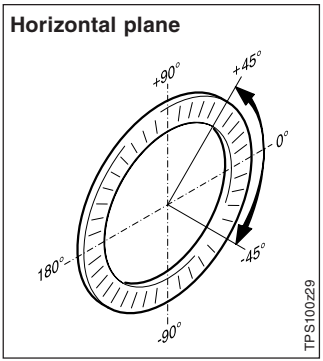
V-angle setting

V / % Sets the "0"-orientation of the V-angle



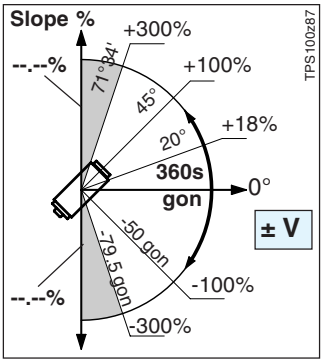
The V-angle increases from 0° - 360° (0 - 400 gon).

↑ is shown on the right of the V-angle



V-angles above the horizontal plane are indicated as positive values and below the horizontal plane as negative values.

→ is shown on the right of the V-angle



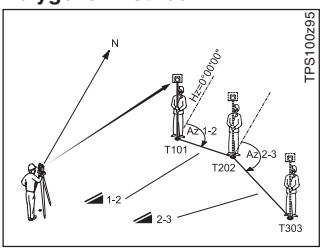
100% correspond to an angle of 45° (50 gon, 800 mil).

The % value increases rapidly. "--.--%" appears on the display above 300%.

Tie Distance

The application Tie Distance computes slope distance, horizontal distance, height difference and azimuth of two measured target points.

Polygonal Method:



Procedure:

1. **Determine first target point.**
   [MEAS] Starts measurement to the target point.

2. **Determine second target point.**
   Proceed as with first target point.

3. **Result is displayed.**
   Brg Azimuth between point1 and point2.
   S dist Slope distance between point1 and point2.
   H dist Horizontal distance between point1 and point2.
   H diff Height difference between point1 and point2.
   [NewPt1] An additional missing line is computed. Program starts again (at point 1).
   [NextPt2] Point 2 is set as starting point of a new missing line. New point (Pt 2) must be measured.

This application allows to define a construction site by combining set-up of the instrument along a construction line and measuring in relation to the line.

Procedure:
Line Start point
[MEAS] Measures to point
[COORD]* Entry of point coordinates
Second Line point
[MEAS] Measures to point
[COORD]* Entry of point coordinates
*) Visible if [SHIFT] is pressed

In case, you have entered coordinates by [COORD] and measured to known points a plausibility check informs you about the calculated line length, the actual length and the difference.

As built check

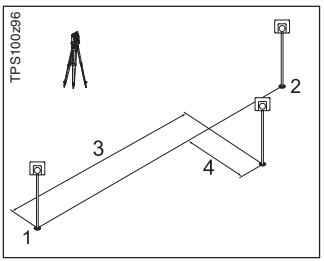
This dialog shows you the ▲Line, ▲Offset and ▲Height of a measured point in relation to the line.

NORTH is positive:
Measured point is in direction from line start - to line end point.

EAST is positive:
Measured point is right of line.

▲Height is positive:
Measured point height is above line start point's height.

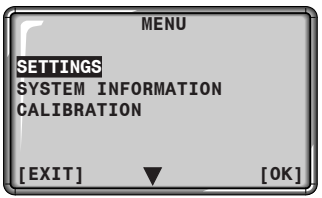
The height of the line start point is always used as the reference height!



1) Line Start point
2) Second Line point
3) North
4) East

MENU (↑ + V/%)

Opens the menu functions.



[EXIT]	Leaves the menu. Back to measuring mode.
▼	Selects the desired menu command.
[OK]	Starts the menu command.

The display contents, particularly lines, contained in this description can vary in local versions of the software.
The function of the display is however identical.

Settings

This menu allows user specific settings in order to adapt the instrument to their own requirements.

The settings are subdivided thematically into three displays:

- System settings
- EDM settings
- Angle / Units

↑ V/%	1. Opens the menu functions.
[OK]	2. Starts the "SETTINGS"
t1 t2	3. Changes display

All parameter section fields are available to the user.

▼ 1. Position focus on desired choice field.
▶ 2. Select setting.
▼ 3. Confirm setting: The focus positions on the next choice field.
[OK] 4. Leaves the display. Back to measuring mode.

Beep

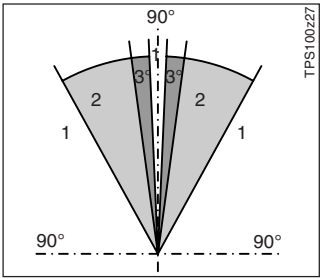
The beep is an acoustic signal after each key stroke.

Off	Beep switched off
Normal	Beep switched on
Loud	Increased volume

Sector Beep

Off	Sector beep switched off.
On	Sector beep sounds at right angles (0°, 90°, 180°, 270° or 0, 100, 200, 300 gon)

Example Sector Beep:
From 95.0 to 99.5 gon (or from 105.0 to 100.5 gon) a "Fast beep" sounds whilst from 99.5 to 99.995 gon (or from 100.5 to 100.005 gon) a "Permanent beep" sounds.

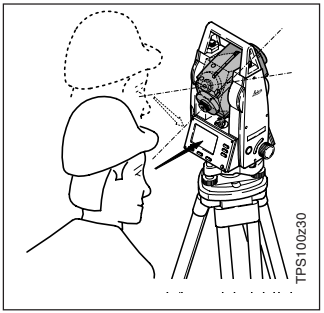


1 No beep
2 Fast beep (interrupted)
3 Permanent beep

Display contrast

10% Setting the display contrast in 10% steps;

The readability of LCDs is influenced by external conditions (temperature, lighting) and by the reading angle (see figure). The display contrast can be adapted step by step until the optimum readability is achieved.



Reticle illumination

The reticle illumination is only switched on if the display illumination is on.

( ).

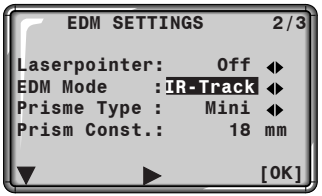
Low	reticle illumination dimmed
Medium	average brightness
High	strong illumination

Display heater

Off	Display heater is switched off.
On	Display heater is automatically activated when the display illumination is on and the instrument temperature is < -5°C.

Auto OFF

Disable	Function is deactivated and the instrument is permanently operating. The battery will not last for as long.
Enable	The instrument is switched off after 15 minutes without any action (= no key pressed; V and Hz angle deviation ≤ ±3' / ±600cc).
Sleep	The instrument switches to economy mode after 15 minutes. Instrument is recovered by [OK].



Laserpointer

Off Visible laser beam is switched off.

On Visible laser beam for defining the target point is switched on.

EDM Mode

The EDM Mode is selected according to the desired distance measurement accuracy and the prism type that is being used. Depending on selected measuring mode the selection prism types are different.
With TCR instruments settings for measurements with visible EDM mode (RL = reflectorless) are available in addition to the settings for measurement with invisible EDM mode (IR = infrared) (see following).

RL-Standard
Distance measurements without prisms with a target distance up to 80 m. (5 mm + 3 ppm)*

RL-Track
Continuous distance measurement without prisms with a target distance up to 80 m. (5 mm + 3 ppm)*

With the RL-EDM each object in the beam is measured (possibly branches, cars, etc.)..

* accuracy
ppm = mm / km

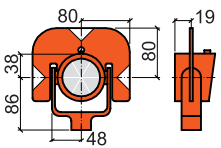
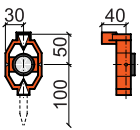
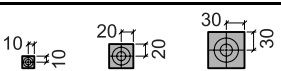
IR-Standard
For distance measurements with prisms with a target distance up to 500 m.
(5 mm + 3 ppm)*

IR-Track
Continuous distance measurement with prisms up to 500 m.
(5 mm + 3 ppm)*

IR-Tape
Distance measurement using Retro targets with a target distance up to 250 m.
(5 mm + 3 ppm)*

* accuracy
ppm = mm / km

Prism type

Leica Geosystems Prisms (Basic Series)		Constants [mm]
Round prism GPR111		0.0
Miniprism GMP111		+17.5
Reflective targets		+34.4
USER is set at "Prismconst" (Example next page)		--
RL (Reflectorless)		+34.4

Prism constant

Entry of a user specific prism constant (refer to chapter *"User Entries"*).
Input can only be made in [mm].

Formula:
Prism constant to be entered = -mm + 34.4

Example:

Non-Leica Geosystems prism constant = 14 mm

=>Prism constant to be entered = -14 + 34.4 = **20.4**

Limit value:
-999 mm to +999 mm

Tilt Correction

Off Compensator switched off.

On Compensator (2 axes) switched on. V-angles relate to plumb line and the Hz-angles are corrected for the tilt of the standing axis.

If the instrument is used on an unstable base (e.g. shaking platform, ship, etc.) **the compensator should be switched off**.
This avoids the compensator drifting out of its measuring range and interupting the measuring process by indicating an error.

The compensator setting remains active even after the instrument is switched off.

Hz collimation

Off Hz-collimation is switched off.
On Hz-collimation is switched on.

If option "Hz-collimation ON" is active, each measured Hz-angle is corrected relative to the V-angle.

For normal operation the Hz-collimation remains switched on.

Find more information about the Hz-collimation in section *"Determining instrument errors"*.

Resolution

The displayed angle format can be selected in three steps.

- **For 360°'":**
  0° 00' 05" / 0° 00' 10"
- **For 360°:**
  0.001° / 0.005° / 0.01°
- **For gon:**
  0.001 gon / 0.005 gon / 0.01 gon
- **For mil:**
  0.01 mil / 0.05 mil / 0.1 mil

Angle

- **° ' " (degree sexagesimal)**
  possible angle values:
  0° to 359°59'59"
- **dec. deg (degree decimal)**
  possible angle values:
  0° to 359.999°
- **gon**
  possible angle values:
  0 gon to 399.999 gon
- **mil**
  possible angle values:
  0 to 6399.99mil

The setting of the angle units can be changed at any time. The actual displayed values are converted according to the selected unit.

Distance

meter	Meter
US-ft	US feet
INT-ft	International feet
ft-in1/8	US feet / inch / 1/8 inch

System Information

Useful information which can be called via menu. These are only indications of actual setting and cannot be changed here. All changes to settings must be carried out in menu "SETTINGS".

MENU (↑ + V/%)	1. Open the menu functions.
▼	2. Select the menu command "SYSTEM INFORMATION".
[OK]	3. Start "SYSTEM INFORMATION"
1 2	4. Change display

Tilt Correction

Display of current compensator setting.

Off Tilt compensation switched off.

On Compensator (2 axes) switched on. V-angles relate to plumb line and the Hz-angles are corrected for the tilt of the standing axis.

Hz collimation

Off Hz-collimation is switched off.

On Hz-collimation is switched on.

Hz-angle direction

Right Hz set to "Right angle measurement" (= clockwise).

Left Hz set to "Left angle measurement" (= anticlockwise).

↺ "Left angle measurements" are only shown in the display.

Battery

Remaining battery power (e.g. 40%).

Instrument temperature

Measured instrument temperature (always in °C).

Display heater (On/Off)

Off Display heater is switched off.

On The display heater is automatically activated when the display illumination is on and the instrument temperature is < -5°C.
When the temperature increases again, the heating is automatically switched off.

Software versions

The instrument software is composed of different software packages. Depending on the package different versions are possible.

Op-System: Operating System
Appl.-SW: Applications, functions and menu
Layout: User displays (Language)

The display contents, particularly lines, contained in this description can vary in local versions of the software.

For data transfer the communication parameters of the serial interface RS232 must be set.

Leica Standard setting
19200 Baud, 8 Databit, No Parity, 1 Stopbit, CR/LF

Baudrate
Data transfer speed 2400, 4800, 9600, 19200
[bits / second]

Databits
7 Data transfer is realized with 7 databits. Is set automatically if parity is "Even" or "Odd".
8 Data transfer is realized with 8 databits. Is set automatically if parity is "None".

Parity

Even	Even parity
Odd	Odd parity
None	No parity (if data bit is set to 8)

Endmark

CRLF	Carriage return; line feed
CR	Carriage return

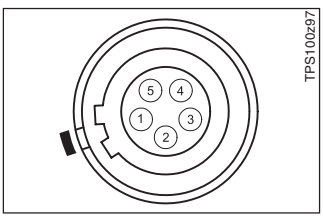
Stopbits
Fixed setting 1.

RS232 Output
On Measurements made in Main Measure Dialog with [DIST] are transfered to RS232.
Off No data transfer if in Main Measure Dialog [DIST] was pressed.

Mask 1/2
Select GSI output mask.

Mask1:	PtID, Hz, V, SD, pp,+mm, hr, hi
Mask2:	PtID, Hz, V, SD, E, N, H, hr

Interface plug connections:



1) External battery
2) Not connected / inactive
3) GND
4) Data reception (TH_RXD)
5) Data transfer (TH_TXD)

TH ... Theodolite

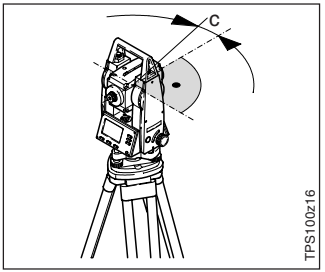
Electronically

The instruments are adjusted in the factory prior to shipping.

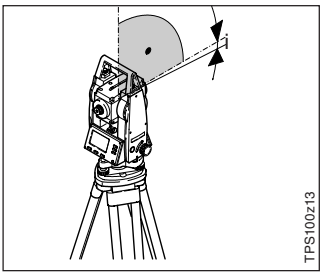
Instrument errors can change with time and temperature.

These errors should be determined before the instrument is used for the first time, before precision surveys, after long periods of transport, before and after long periods of work, and if the temperature changes by more than 10°C (18°F).

Before determining the instrument errors, level-up the instrument using the electronic bubble. The instrument should be secure and firm, and should be protected from direct sunlight in order to avoid thermal warming on one side only.



The line-of-sight error or collimation error (C) is the deviation from the perpendicular between the tilting axis and the line of sight.
The effect of the line-of-sight error to the Hz-angle increases with the vertical angle.
For horizontal aimings the error of the Hz-angle equals the line-of-sight error.



The vertical circle should read exactly 90° (100 gon) when the line of sight is horizontal. Any deviation from this figure is termed vertical index error (i).

By determining the vertical index error the electronic level is adjusted automatically.

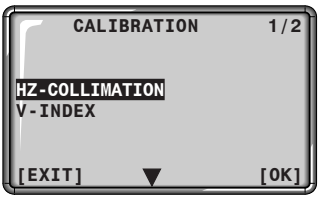
The calibration contains the determination of the following instrument errors:

- Line-Of-Sight Error (Hz-collimation)
- Vertical Index Error (V-Index)
  The electronic level is adjusted simultaneously.

MENU (↑ + V/%)
1. Open the menu functions.

▼ 2. Select the menu command "CALIBRATION".

[OK] 3. Start "CALIBRATION"



[OK] 4. Start "HZ-COLLIMATION"

or

▼ 4. Select the menu command "V-INDEX".

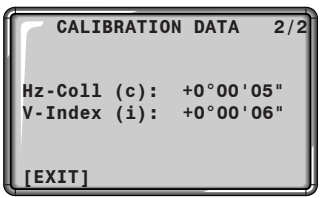
[OK] 5. Start "V-INDEX"

For determining the Hz-collimation or the V-index it is necessary to measure in both telescope faces. The procedure can be started in any telescope face.

The user is guided clearly through the procedure. As a result, a wrong determination of instrument errors is eliminated.

Calibration data

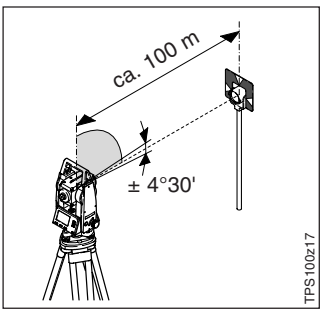
Overview of the last determined and saved values (Hz-collimation, V-index).



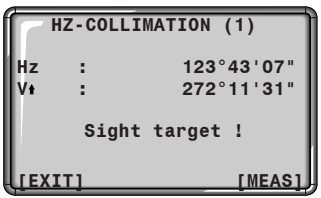
Buttons

[MEAS]	Measurements are triggered exclusively by pressing this button . DIST is not active during calibration
[EXIT]	Back to calibration menu without saving.

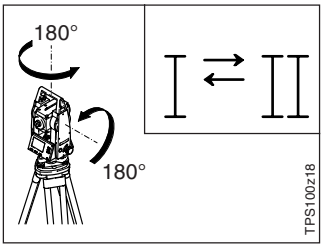
1. Level up instrument exactly using the electronic level.
2. Start Hz-collimation (refer to p. 55).
3. Aim at a point approximately 100m from the instrument that is less than ± 4°30' (5 gon) from the horizontal.



For checking the horizontal aiming Hz- and V-angles are displayed.

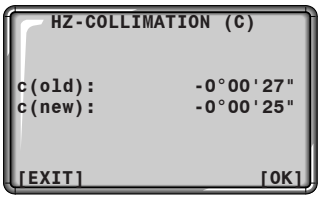


4. [MEAS] Trigger measurement.
5. Change telescope face and aim on point again.



6. [MEAS] Trigger measurement again.

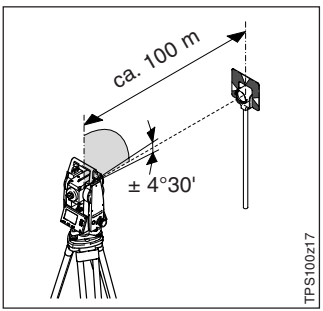
7. Indication of previous and recomputed line-of-sight-error.



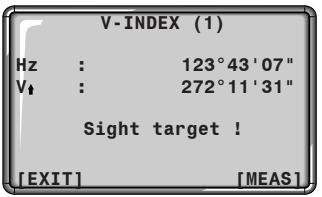
8. [OK] Accept new value
   or
   [EXIT] Reject new value.

Determining V-Index

1. Level up instrument exactly using the electronic level.
2. Start V-Index (refer to p. 55)
3. Aim at a point approximately 100m from the instrument that is less than ± 4°30' (5 gon) from the horizontal.

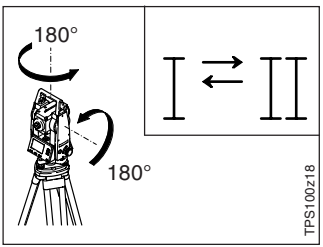


For checking the horizontal aiming Hz- and V-angles are displayed.

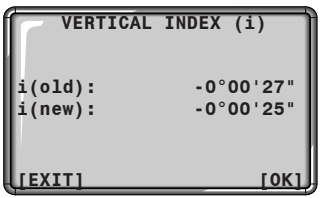


4. [MEAS] Trigger measurement.

5. Change telescope position and aim on point again.



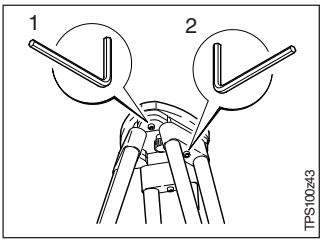
6. [MEAS] Trigger measurement again.
7. Indication of previous and recomputed V-index.



8. [OK] Accept new value
   or
   [EXIT] Reject new value.

By determining the vertical index error the electronic level is adjusted automatically.

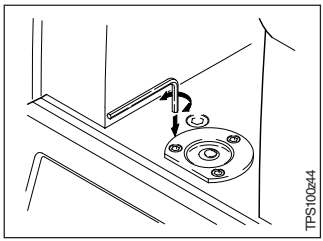
Tripod



The connections between metal and timber components must always be firm and tight.

- Tighten the Allen screws (2) moderately.
- Tighten the articulated joints on the tripod head (1) just enough to keep the tripod legs open when you lift it off the ground.

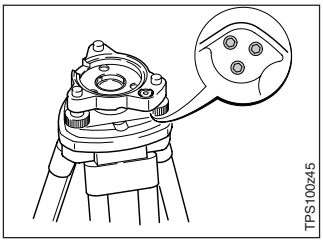
Circular Level



Level-up the instrument in advance with the electronic level. The bubble must be centered. If it extends beyond the circle, use the Allen key supplied to center it by turning the adjustment screws.

After adjustment no screw must be loose.

Circular Level on the Tribrach

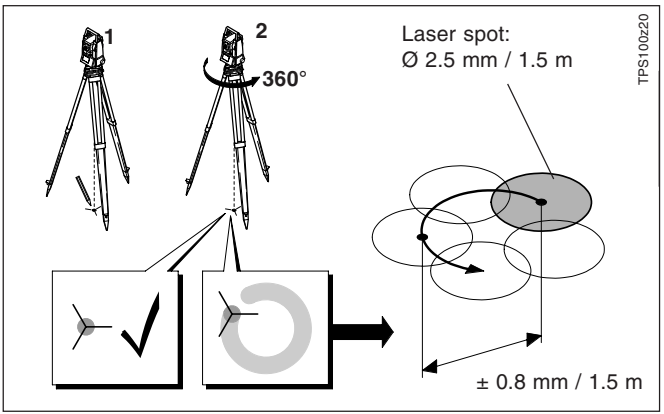


Level the instrument and then remove it from the tribrach. If the bubble is not centred, adjust it using the adjusting pin.

Turn the adjustment screws:

- to the left: the bubble approaches the screw
- to the right: the bubble goes away from the screw.

The laser plummet is integrated into the vertical axis of the instrument. Under normal circumstances setting of the laser plummet is not necessary. If an adjustment is necessary due to external influences the instrument has to be returned to any Leica service department.



Checking by turning the instrument by 360°:

1. Install the instrument on the tripod approx. 1.5 m above ground and level up.
2. Switch on laser plummet and mark the centre of the red spot.
3. Turn instrument slowly through 360° and observe the red laser spot.

Inspecting the laser plummet should be carried out on a bright, smooth and horizonal surface (e.g. a sheet of paper).

If the centre of the laser spot makes a clear circular movement or if the centre of the point is moving away more than 1mm from the first marked point an adjustment is possibly necessary. Call your nearest Leica service department.

Depending on brightness and surface the size of the laser spot can vary. At a distance of 1.5 m an average value of 2.5 mm diameter must be estimated.

The maximum diameter of the circular movement of the centre of the laser spot should not exceed +/- 0.8 mm at a distance of 1.5 m.

The red laser beam used for measuring without reflector is arranged coaxially with the line of sight of the telescope, and emerges from the objective port. If the instrument is well adjusted, the red measuring beam will coincide with the visual line of sight. External influences such as shock or large temperature fluctuations can displace the red measuring beam relative to the line of sight.

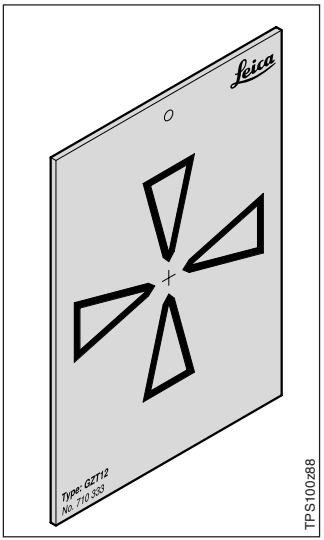
The direction of the beam should be inspected before precise measurement of distances is attempted, because an excessive deviation of the laser beam from the line of sight can result in imprecise distance measurements.

Inspection

A target plate is provided. Set it up between five and 20 metres away with the grey reflective side facing the instrument. Move the telescope to face II. Switch on the red laser beam by activating the laser-point function. Use the telescope crosshair to align the instrument with the centre of the target plate, and then inspect the position of the red laser spot on the target plate. Generally speaking the red spot cannot be seen through the telescope, so look at the target plate from just above the telescope or from just to the side of it.

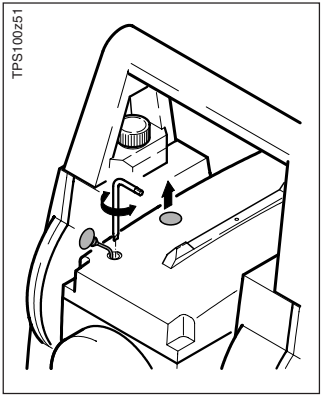
If the spot illuminates the cross, the achievable adjustment precision has been reached. If it lies outside the limits of the cross, the direction of the beam needs to be adjusted.

If the spot on the more reflective side of the plate is too bright (dazzling), use the white side instead to carry out the inspection.



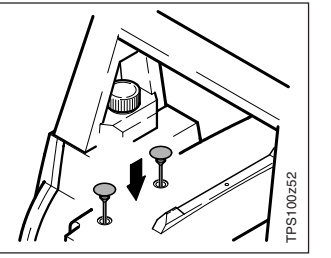
Adjusting the Direction of the Beam

Pull the two plugs out from the adjustment ports on the top side of the telescope housing.
To correct the height of the beam, insert the screwdriver into the rear adjustment port and turn it clockwise (spot on target plate moves obliquely upwards) or anticlockwise (spot moves obliquely downwards).
To correct the beam laterally, insert the screwdriver into the front adjustment port and turn it clockwise (spot moves to the right) or anticlockwise (spot moves to the left).



Throughout the adjustment procedure, keep the telescope pointing to the target plate.

After each field adjustment, replace the plugs in the adjustment ports to keep out damp and dirt.

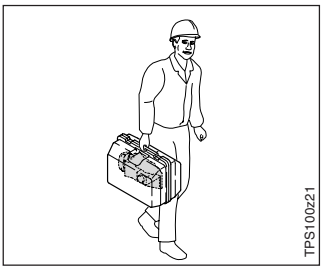


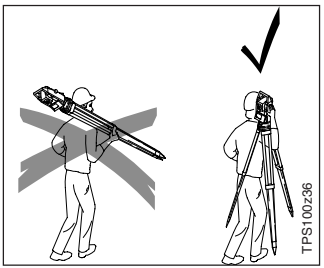
Transport

When transporting or shipping the equipment always use the original Leica Geosystems packaging (transport case and shipping cardboard).

After a longer period of storage or transport of your instrument always check the field ajustment parameters indicated in this manual before using the instrument.

In the Field





When transporting the equipment **in the field**, always make sure to

- either carry the instrument in its original transport case or,
- carry the tripod with its legs splayed across your shoulder, keeping the attached instrument upright.

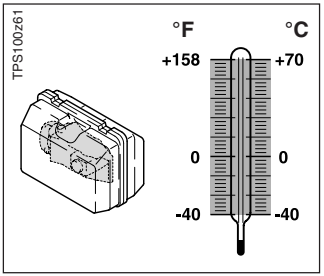
Inside Vehicle

Never transport the instrument loose **inside the vehicle**. The instrument can be damaged by blows and vibrations. It must always be transported in its case and be properly secured.

Shipping

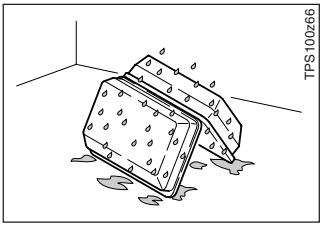
For shipping the instrument by **rail**, **aircraft** or **ship** use the Leica Geosystems original packaging (transport case or shipping cardboard) or another suitable packaging securing the instrument against blows and vibrations.

Storage



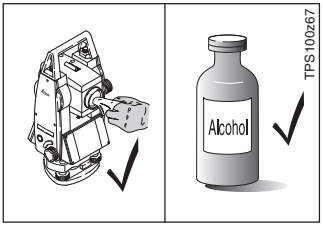
When storing the equipment, particularly in summer and inside a vehicle, take the **temperature limits** into account.

When storing the intrument inside a building also use the transport case (if possible, in a safe place).



If the instrument becomes wet, leave it unpacked. Wipe down, clean, and dry the instrument (at not more than 40 °C/ 104°F), transport case, foam inserts, and accessories. Pack up the equipment only when it is perfectly dry.

When using the instrument in the field always close the transport case.



Objective, eyepiece and prisms:

- Blow dust off lenses and prisms.
- Never touch the glass with fingers.
- Use only a clean, soft and lint-free cloth for cleaning. If necessary, moisten the cloth with pure alcohol.

Use no other liquids; these may attack polymer components.

Fogging of prisms: Reflector prisms that are cooler than the ambient temperature tend to fog. It is not enough simply to wipe them. Keep them for some time inside your jacket or in the vehicle to allow them to adjust to the ambient temperature.

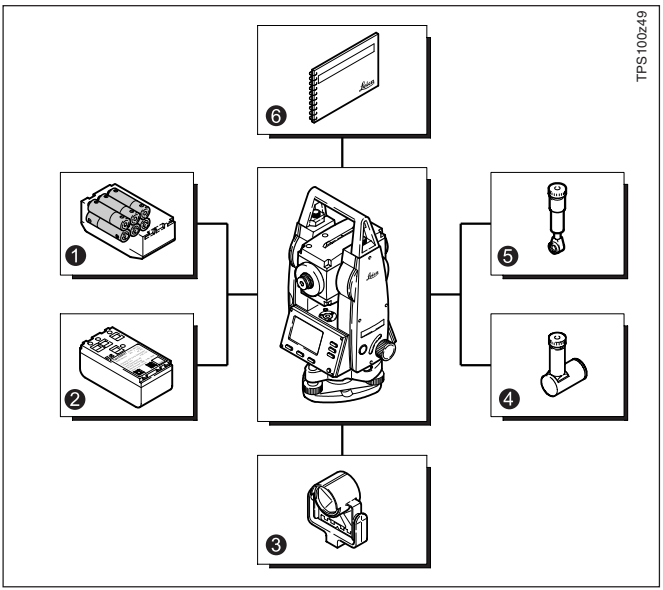
Cables and plugs: Keep plugs clean and dry. Blow away any dirt lodged in the plugs of the connecting cables.

Overview of frequent messages and warnings.

Message / Warning	Meaning / Cause	Measure
System		
Low battery !	The battery has reached 20% of its capacity.	Change or charge battery.
Sleep mode ! Press OK to wake up!	Auto OFF is set to "Sleep" in the system settings.	Press [OK].
Shut down !	Auto OFF is set to "Enable" in the system settings.	Change setting.
Temperature out of range !	The ambient temperature is outside the specifications (-20°C to +50°C; -4°F to +122°F). The instrument is switched off automatically (safety function !)	Cool or warm instrument, as applicable.
Contact service !	A system error occured requiring a service.	Rectifying this error by your local Leica Service station.

Message / Warning	Meaning / Cause	Measure
Distance measurement		
No Laserpointer installed !	The visible laser beam for defining the target point cannot be switched on because an instrument of the type TC is being used.	Use instrument of type TCR.
Weak Signal ! Error Nr. 6 or 54	The distance measurement could not be triggered within the given time (distance too long, beam interrupted, …)..	Check pointing or reduce range. Repeat measurement.
Signal too strong !	The EDM signal is too strong (e.g. measurement with RL-EDM to prisms).	Change EDM type or target type.
Angle measurement		
Instrument tilt ! Level instrument !	The Compensator is out of measuring range.	Level instrument or switch off compensator.

Message / Warning	Meaning / Cause	Measure
Calibration		
V-Angle not suitable for calibration ! (Check V-Angle or face)	Aiming tolerance not met or telescope position/face not changed.	The target point must be approximately in the horizontal plane ± 4°30'. Confirmation of the message required.
Result out of tolerance and will be rejected !	Computed values out of tolerance. Previous values retained.	Repeat measurements. Confirmation of the message required.
Hz-Angle out of limit !	Hz-angle in second face/telescope pos. deviates more than 4°30' from the target point.	Aim on the target point with an accuracy of min. 4°30'. Confirmation of the message required.
Unstable condition or instrument is tilted ! Try again !	Measurement error appeared (e.g. instable set up or period between measuring in telescope position I and II too long).	Repeat the process. Confirmation of the message required.



1) **Battery adapter GAD39**
(Art. Nr. 712156)

2) **Battery GEB121**
(Art. Nr. 667123)

3) **Leica round prism GPR111**
(Art. Nr. 641618)

4) **Eyepiece for steep angles**
(Art. Nr. 376236)

5) **Diagonal eyepiece GFZ1**
(Art. Nr. 363880)

6) **Booklet:**
Surveying made easy
(available in English
(Art. Nr. 722510) and
German (Art. Nr. 722383))

Intended Use of Instrument

The following directions should enable the person responsible for the TC(R)110ℂ, and the person who actually uses the instrument, to anticipate and avoid operational hazards.

The person responsible for the instrument must ensure that all users understand these directions and adheres to them.

Permitted Uses

The electronic total stations are intended to the following applications:

- Measuring horizontal and vertical angles
- Measuring distances
- Visualising the standing axis (with laser plummet)

Adverse Uses

- Use of the product without instruction
- Use outside of the intended limits
- Disabling safety systems
- Removal of hazard notices
- Opening the instrument using tools (screwdriver, etc.), unless this is specifically permitted for certain functions
- Modification or conversion of the product
- Use after misappropriation
- Use with accessories from other manufacturers without the prior express approval of Leica Geosystems

- Aiming directly into the sun
- Inadequate safeguards at the surveying site (e.g. when measuring on roads, etc.)
- Controlling machines, or controlling moving objects or similar, with the integrated EDM (visible laser)
- Deliberate dazzling of third parties

WARNING:
Adverse use can lead to injury, malfunction, and material damage.
It is the task of the person responsible for the instrument to inform the user about hazards and how to counteract them.
The electronic total stations are not to be used until the user has been properly instructed how to use them.

Environment:
Suitable for use in an atmosphere appropriate for permanent human habitation: not suitable for use in aggressive or explosive environments. Use in rain is permissible for limited periods.

Refer to chapter "Technical Data".

DANGER:
Local safety authorities and safety experts must be contacted before working in hazardous explosive areas or in extreme environment conditions by the person in charge of the instrument. This includes the use of a lockable battery holder to prevent accidental opening of the compartment.

Area of responsibility for the manufacturer of the original equipment Leica Geosystems AG, CH-9435 Heerbrugg (hereinafter referred to as Leica Geosystems):
Leica Geosystems is responsible for supplying the product, including the User Manual and original accessories, in a completely safe condition.

Responsibilities of the manufacturers of non-Leica Geosystems accessories:
The manufacturers of non-Leica Geosystems accessories for the electronic total stations are responsible for developing, implementing and communicating safety concepts for their products, and are also responsible for the effectiveness of those safety concepts in combination with the Leica Geosystems product.

Responsibilities of the person in charge of the instrument:

WARNING:
The person responsible for the instrument must ensure that it is used in accordance with the instructions. This person is also accountable for the training and deployment of personnel who use the instrument and for the safety of the equipment when in use.

The person in charge of the instrument has the following duties:

- To understand the safety instructions on the product and the instructions in the User Manual.
- To be familiar with local regulations relating to accident prevention.
- To inform Leica Geosystems immediately if the equipment becomes unsafe.

WARNING:
The absence of instruction, or the inadequate imparting of instruction, can lead to incorrect or adverse use, and can give rise to accidents with far-reaching human, material, financial and environmental consequences.
Precautions:
All users must follow the safety directions given by the manufacturer and the directions of the person responsible for the instrument.

WARNING:
Using a battery charger not recommended by Leica Geosystems can destroy the batteries. This can cause fire or explosions.
Precautions:
Only use chargers recommended by Leica Geosystems to charge the batteries.

DANGER:
Because of the risk of electrocution, it is very dangerous to use reflector poles and extensions in the vicinity of electrical installations such as power cables or electrical railways.

Precautions:
Keep at a safe distance from electrical installations. If it is essential to work in this environment, first contact the safety authorities responsible for the electrical installations and follow their instructions.

WARNING:
By surveying during a thunderstorm you are at risk from lightening.

Precautions:
Do not carry out field surveys during thunderstorms.

CAUTION:
Be careful when pointing the product towards the sun, because the telescope functions as a magnifying lens and can injure your eyes or damage the distance measuring device and the Guide Light EGL.
Precautions:
Do not point the telescope directly at the sun.

WARNING:
During target recognition or stakeout procedures there is a danger of accidents occurring if the user does not pay attention to the environmental conditions (e.g. obstacles, excavations or traffic).
Precautions:
The person responsible for the instrument must make all users fully aware of the existing dangers.

WARNING:
Inadequate securing of the surveying site can lead to dangerous situations, for example in traffic, on building sites and at industrial installations.
Precautions:
Always ensure that the surveying site is adequately secured. Adhere to the local regulations governing accident prevention and road traffic.

CAUTION:
If a target lamp accessory is used with the instrument the lamp's surface temperature may be extreme after a long working period. It may cause pain if touched. Replacing the halogen bulb before the lamp has been allowed to cool down may cause burning to the skin or fingers.
Precautions:
Use appropriate heat protection such as gloves or woollen cloth before touching the lamp, or allow the lamp to cool down first.

WARNING:
If computers intended for use indoors are used in the field there is a danger of electric shock.
Precautions:
Adhere to the instructions given by the computer manufacturer with regard to field use in conjunction with Leica Geosystems instruments.

CAUTION:
During the transport or disposal of charged batteries it is possible for inappropriate mechanical influences to constitute a fire hazard.
Precautions:
Before transporting or disposing of equipment, discharge the battery (e.g. by running the instrument in tracking mode until the batteries are exhausted).

WARNING:
If the equipment is improperly disposed of, the following can happen:

- If polymer parts are burnt, poisonous gases are produced which may impair health.
- If batteries are damaged or are heated strongly, they can explode and cause poisoning, burning, corrosion or environmental contamination.
- By disposing of the equipment irresponsibly you may enable unauthorized persons to use it in contravention of the regulations, exposing themselves and third parties to the risk of severe injury and rendering the environment liable to contamination.
- Leakage of silicone oil from the compensator can damage the optical and electronic subassemblies.

Precautions:
Dispose of the equipment appropriately in accordance with the regulations in force in your country. Always prevent access to the equipment by unauthorized personnel.

CAUTION:
If the accessories used with the instrument are not properly secured, and the equipment is subjected to mechanical shock (e.g. blows, falling etc.), the equipment may be damaged, safety devices may be ineffective or people may sustain injury.

Precautions:
When setting-up the instrument, make sure that the accessories (e.g. tripod, tribrach, etc.) are correctly adapted, fitted, secured and locked in position.
Avoid subjecting the equipment to mechanical shock.
Never position the instrument on the tripod baseplate without securely tightening the central fixing screw. If the screw is loosened always remove the instrument immediately from the tripod.

CAUTION:
Watch out for erroneous measurements if the instrument is defective or if it has been dropped or has been misused or modified.

Precautions:
Periodically carry out test measurements and perform the field adjustments indicated in the User Manual particularly after the instrument has been subjected to abnormal use and before and after important measurements.

Integrated EDM (Infrared Laser)

CAUTION:
Only Leica Geosystems - authorized workshops are entitled to repair these products.

The EDM module built into the total stations produces an invisible infra-red laser beam which emerges from the telescope objective.

The product is a Class 1 laser product in accordance with:

- IEC 60825-1:1993 "Radiation safety of laser products".
- EN 60825-1:1994 + A11:1996 "Radiation safety of laser products".

The product is a Class I laser product in accordance with:

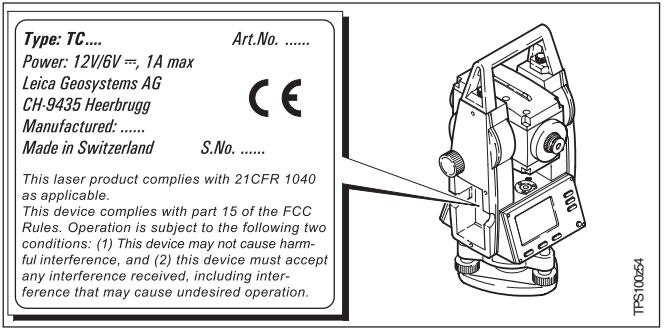
- FDA 21CFR Ch.I §1040 : 1988 (US Department of Health and Human Service, Code of Federal Regulations)

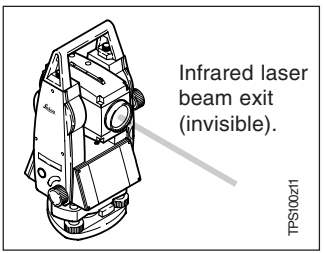
Class 1/I laser products are safe under reasonably foreseeable conditions of operation and are not harmful to the eyes provided that the products are used and maintained in accordance with the instructions.

Class 1 Laser Product

according to
IEC 60825-1:1993

Beam divergence	1.8 mrad
Pulse duration	800 ps
Maximum radiant power	0.33 mW
Maximum radiant power per pulse	4.12 mW
Measurement uncertainty	± 5%


Type: TC....
Art.No. .....
Power: 12V/6V ⎓, 1A max
Leica Geosystems AG
CH-9435 Heerbrugg
Manufactured: .....
Made in Switzerland
S.No. .....
This laser product complies with 21CFR 1040 as applicable.
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
TPS100254



As an alternative to the infrared beam, the EDM incorporated into the total station produces a visible red laser beam which emerges from the telescope objective.

The product is a Class 2 laser product in accordance with:

- IEC60825-1:1993 "Radiation safety of laser products"
- EN60825-1:1994 + A11:1996 "Radiation safety of laser products"

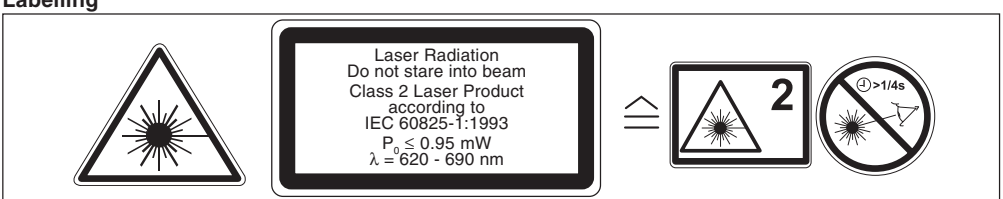
The product is a Class II laser product in accordance with:

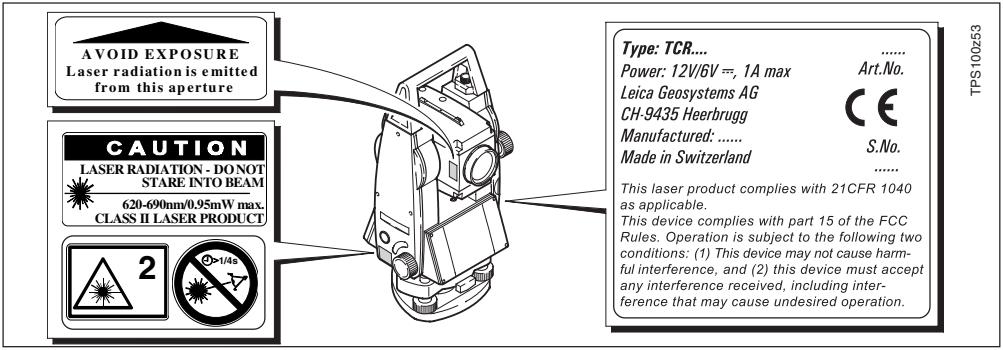
- FDA 21CFR Ch.I §1040 : 1988 (US Department of Health and Human Service, Code of Federal Regulations)

Class 2/II laser products:
Do not stare into the beam or direct it unnecessarily at other persons. Eye protection is normally afforded by aversion responses including the blink reflex.

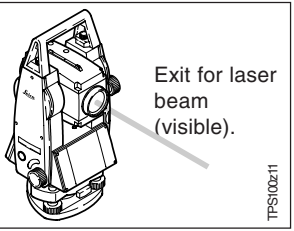
WARNING:
It can be dangerous to look into the beam with optical equipment (e.g. binoculars, telescopes).
Precautions:
Do not look directly into the beam with optical equipment.

Labelling




AVOID EXPOSURE
Laser radiation is emitted from this aperture
CAUTION
LASER RADIATION - DO NOT STARE INTO BEAM
620-690nm/0.95mW max.
CLASS II LASER PRODUCT
2
>1/4s
Type: TCR.... .....
Power: 12V/6V ⎓, 1A max Art.No.
Leica Geosystems AG
CH-9435 Heerbrugg
Manufactured: .....
Made in Switzerland S.No. .....
This laser product complies with 21CFR 1040 as applicable.
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
TPS100z53

Beam divergence	0.15 x 0.35 mrad
Pulse duration	800 ps
Maximum radiant power	0.95 mW
Maximum radiant power per pulse	12 mW
Measurement uncertainty	± 5%



The integrated laser plummet produces a visible laser beam which emerges from the base of the instrument.

The product is a Class 2 laser product in accordance with:

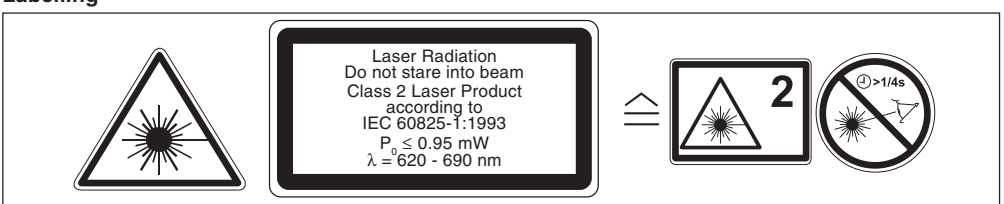
- IEC60825-1:1993 "Radiation safety of laser products"
- EN60825-1:1994 + A11:1996 "Radiation safety of laser products"

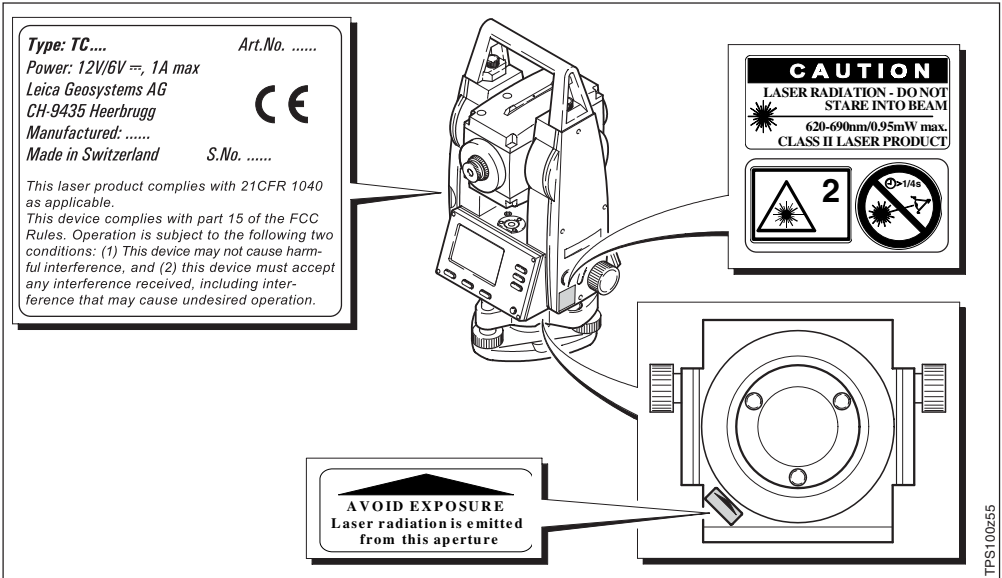
The product is a Class II laser product in accordance with:

- FDA 21CFR Ch.I §1040 : 1988 (US Department of Health and Human Service, Code of Federal Regulations)

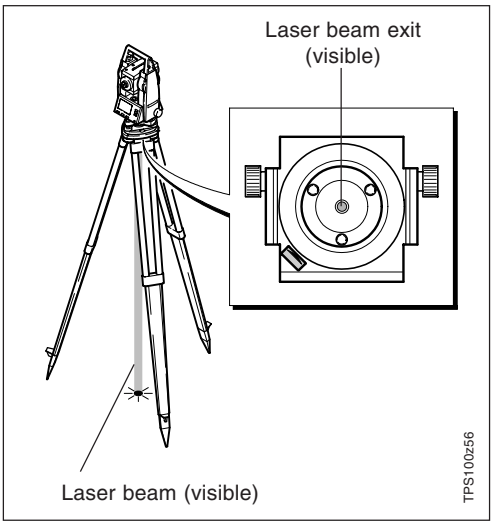
Class 2/II laser products:
Do not stare into the beam or direct it unnecessarily at other persons. Eye protection is normally afforded by aversion responses including the blink reflex.

Labelling




Type: TC....
Art.No. .....
Power: 12V/6V ⎓, 1A max
Leica Geosystems AG
CH-9435 Heerbrugg
Manufactured: .....
Made in Switzerland
S.No. .....
This laser product complies with 21CFR 1040 as applicable.
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
CAUTION
LASER RADIATION - DO NOT STARE INTO BEAM
620-690nm/0.95mW max.
CLASS II LASER PRODUCT
2
>1/4s
AVOID EXPOSURE
Laser radiation is emitted from this aperture
TPS100z55

Beam divergence	0.16 x 0.6 mrad
Pulse duration	c.w.
Maximum radiant power	0.95 mW
Maximum radiant power per pulse	n/a
Measurement uncertainty	±5%



The term "electromagnetic compatibility" is taken to mean the capability of the instrument to function correctly in an environment where electromagnetic radiation and electrostatic discharges are present, and without causing electromagnetic disturbances in other equipment.

WARNING:
Electromagnetic radiation can cause disturbances in other equipment.

Although electronic total stations meet the strict regulations and standards which are in force in this respect, Leica Geosystems cannot completely exclude the possibility that other equipment may be disturbed.

CAUTION:

There is a risk that disturbances may be caused in other equipment if the total station is used in conjunction with accessories from other manufacturers, e.g. field computers, personal computers, walkie-talkies, non-standard cables, external batteries.
Precautions:
Use only the equipment and accessories recommended by Leica Geosystems. When combined with total stations, they meet the strict requirements stipulated by the guidelines and standards. When using computers and walkie-talkies, pay attention to the information about electromagnetic compatibility provided by the manufacturer.

CAUTION:
Disturbances caused by electromagnetic radiation can result in the tolerance limits for measurements being exceeded.

Although the total stations meet the strict regulations and standards which are in force in this connection, Leica Geosystems cannot completely exclude the possibility that the total station may be disturbed by very intense electromagnetic radiation, e.g. near radio transmitters, walkie-talkies, diesel generators, power cables. Check the plausibility of results obtained under these conditions.

WARNING:
If the total station is operated with connecting cables attached at only one of their two ends (e.g. external supply cables, interface cables), the permitted level of electromagnetic radiation may be exceeded and the correct functioning of other instruments may be impaired.
Precautions:
While the total station is in use, connecting cables (e.g. instrument to external battery, instrument to computer) must be connected at both ends.

FCC Statement (Applicable in U.S.)

WARNING:
This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.
This equipment generates, uses and can radiate frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.
However, there is no guarantee that interference will not occur in a particular installation.

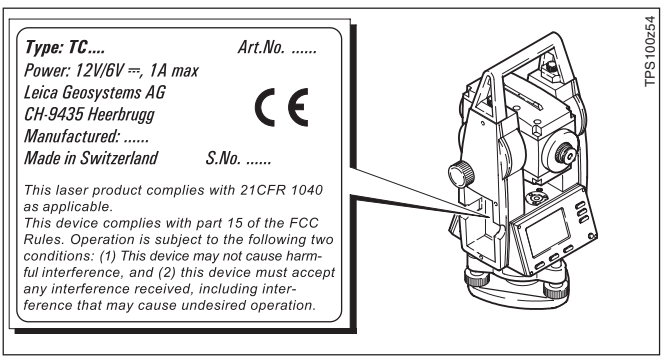
If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

WARNING:
Changes or modifications not expressly approved by Leica Geosystems for compliance could void the user's authority to operate the equipment.

Product labelling:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.


Type: TC....
Art.No. .....
Power: 12V/6V ⎓, 1A max
Leica Geosystems AG
CH-9435 Heerbrugg
Manufactured: .....
Made in Switzerland
S.No. .....
This laser product complies with 21CFR 1040 as applicable.
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
TPS100z54

Telescope

- Transits fully
- Magnification:
  30x
- Image:
  upright
- Free objective aperture:
  40 mm
- Shortest focussing distance:
  1.7 m (5.6 ft)
- Focusing:
  fine
- Field of view:
  1°30' (1.7gon)
- Telescope field of view at 100 m: 2.6 m

Angle measurement

- absolute, continuous,
- Updates each 0.3 seconds
- Units selectable
  360° sexagesimal, 400gon, 360° decimal, 6400 mil, V%, ±V
- Accuracy standard deviation Hz, V (acc. to ISO 17123-3)
  10" (3 mgon)
  5 mm @ 100 m
  1/4 inch @ 400 ft
- Smallest display resolution

gon:	0.001
360d:	0.001
360s:	5"
mil:	0.01

Level sensitivity

- Circular level:
  6'/2 mm

Compensator

- 2-axis-oil compensator
- Setting range
  ±4' (0.07 gon)
- Setting accuracy
  3" (1 mgon)

Laser plummet
- In alidade, turns with instrument
- Accuracy: max. rot.-ø of laser spot: ± 0.8 mm/1.5m
- Point-ø of laser spot: 2.5mm / 1.5m

Keyboard
- Tilt angle: 70°

Display
- Backlit
- Heatable (Temp. < -5°C)
- LCD: 144x64 Pixel
- 8 lines with 24 characters each

Type of tribrach
- Tribrach removable GDF101 (red)
  Thread-ø: 5/8" (DIN 18720 / BS 84)
- Tribrach shiftable GUS75 (red)
  Thread-ø: M35x2 (DIN 13) with adapter 5/8"

Dimensions
- Instrument:
  Height (including tribrach and carrying handle):
  - with tribrach GDF101 360 mm ± 5 mm
  - with tribrach GUS75 358 mm ± 5 mm
  Width: 151 mm
  Length: 203 mm
- Case: 468x254x355 mm (LxWxH)

Tilting axis height
- without tribrach 196 mm
- with tribrach GDF101 240 mm ± 5 mm
- with tribrach GUS75 238 mm ± 5 mm

Weight

including battery GEB111 and tribrach:

- with GDF101 4.88 kg
- with GUS75 5.10 kg

without battery and tribrach: 3.94 kg

Power supply

- Battery GEB111: NiMh (0% Cadmium)
  Voltage: 6V, 2100 mAh
- Battery GEB121: NiMh (0% Cadmium)
  Voltage: 6V, 4200 mAh
- Battery adapter GAD39: 6 x LR6/AA/AM3, 1.5V, only alkaline batteries

Number of measurements

GEB111:

- Angle: > 4 h
- Distance: > 1000

GEB121:

- Angle: > 8 h
- Distance: > 2000

Temperature range

- Storage: -40°C bis +70°C
  -40°F bis +158°F
- Operating: -20°C bis +50°C
  -4°F bis +122°F

Automatic corrections

• Line-of-sight error	Yes
• Vertical-index error	Yes
• Earth curvature	Yes
• Refraction	Yes
• Tilt correction	Yes

Distance measurement (IR: infrared)

- Type: infrared
- Carrier wavelength: 0.780 µm
- Measuring system: special frequency system basis 100 MHz ≙ 1.5 m
- EDM type: coaxial
- Display (least count): 1 mm

EDM measuring program	Time per measurement
IR-Standard	<0.5 sec.
IR-Track	<0.3 sec.
IR-Tape	<0.5 sec.

- Accuracy (Standard deviation acc. to ISO 17123-4)
  The distance measuring accuracy is 5mm + 3ppm for the listed EDM measuring programs* (6mm @ 300m; 1/4 inch @ 1500ft).
  * ppm = mm / km

Beam interruptions, severe heat shimmer and moving objects within the beam path can result in deviations from the specified accuracy.

	Range		
	Miniprism	Round prism	Tape 60mm x 60mm
1	400 m (1300 ft)	400 m (1300 ft)	150 m (500 ft)
2	500 m (1600 ft)	500 m (1600 ft)	250 m (800 ft)
3	500 m (1600 ft)	500 m (1600 ft)	250 m (800 ft)

1) Strong haze, visibility 5km; or strong sunlight, severe heat shimmer
2) Light haze, or moderate sunlight, slight heat shimmer, visibility about 20km
3) Overcast, no haze, visibility about 40km; no heat shimmer

Distance measurement (RL: reflectorless)

- Type: visible red laser
- Carrier wavelength: 0.670 µm
- Measuring system: special frequency system basis 100 MHz ≙ 1.5 m
- EDM type: coaxial
- Display (least count): 1 mm
- Laser spot size: approx. 7 x 14 mm / 20 m ca. 10 x 20 mm / 50 m
- Range of measurement: 1.5 m to 80 m (to target plate art.no. 710333)
- Prism constant: + 34.4 mm

EDM measuring program	Time per measurement
RL-Standard	3.0 sec. +1.0 sec./10m > 30m
RL-Track	1.0 sec. +0.3 sec./10m > 30m

- Accuracy (Standard deviation acc. to ISO 17123-4) The distance measuring accuracy is 5mm + 3ppm for the listed EDM measuring programs (6mm @ 300m; 1/4 inch @ 1500ft).

Beam interruptions, severe heat shimmer and moving objects within the beam path can result in deviations from the specified accuracy.

	Range	
Atmospheric conditions	No reflector (white target)*	No reflector (gray, albedo 0.25)*
4	60 m (200 ft)	30 m (100 ft)
5	80 m (260 ft)	50 m (160 ft)
6	80 m (260 ft)	50 m (160 ft)

* Kodak Grey Card used with exposure meter for reflected light

4) Object in strong sunlight, severe heat shimmer
5) Object in shade, or sky overcast
6) Day, night and twilight

Index

A

Abbreviations 11
Accessories 71
Accuracy 92, 95
Accurate levelling-up 29
Adjusting 54
Adjusting the direction of the beam 64
Angle 49
Angle measurement 38, 92
Angle settings 48
Area of applicability 8
As built check 41
Auto OFF 45
Automatic corrections 94
Azimuth 40

B

Battery 23, 51
Battery adapter GAD39 ..... 10, 23, 71
Battery capacity 16
Battery GEB111 10
Battery GEB121 ..... 10, 71
Baudrate 53
Beep 43
Brg 40
Buttons 15, 56

C

Calibration data 56
Care 65
Centring with laser plummet 28
Centring with shifting tribrach 31
Change display 13, 32
Character set 20
Checking 54
Choice fields 21
Circular level 10, 60
Circular level on the tribrach 60
Cleaning 67
Coarse level-up 28
Collimation axis 11
Compensator 12, 16, 92
Construction application 41
Coordinate measurement 36

D
Databits 53
Determining instrument errors 55
Determining the line-of-sight error (c) 57
Determining V-index 58
Diagonal eyepiece GFZ1 71
Dimensions 93
Display 10, 93
Display contrast 44
Display heater 45, 52
Display resolution 92
Displayed data 32
Distance 50
Distance measurement 33, 95, 96

E
Economy mode 45
EDM change (TCR only) 37
EDM mode 46
EDM settings 46
EDM type 16
Electromagnetic compatibility (EMC) 88
Endmark 53
Eyepiece 10
Eyepiece for steep angles 71

F
Fixed keys 13
Focus 15
Foot screws 10
Function keys 13

G
GEB111 23
GEB121 23

H
Hazards of use 75
Hdiff 40
Hdist 40
Hints for positioning 30
Horizontal angle 11
Horizontal circle 11
Horizontal drive 10
Horizontal plane 39
Hz collimation 49, 51
Hz-angle direction 51
Hz-Collim. 54

I
Important components 10
Infrared laser 81
Input fields 20
Inserting battery 24
Inspection 63
Instrument temperature 51
Integrated EDM 81, 83
Intended use of instrument 72
Interface plug connections 53
IR-Standard 47
IR-Tape 47
IR-Track 47
IR: infrared 95

K
Key combinations 14
Keyboard 13, 93
Keypad 10

L
Laser classification 81
Laser intensity 30
Laser plummet 61, 85, 93
Laserpointer 46
Laserpointer (TCR only) 37
Leica round prism GPR111 71
Level sensitivity 92
Limits of use 73
Line of sight 11
Line-of-sight error 54

M
Measuring 32
Measuring preparation 22
Menu 42
Menu tree 17
Messages 68

N
Number of measurements 94

O
Objective 10
ON/OFF keys 13
Operating concept 13
Orientation of the V-angle 39

P
Parity 53
Plumb line 12
Pointing 33
Polygonal Method 40
Power supply 94
Prism constant 48
Prism type 47
Programs 40

R
Range 95, 96
Reflector height 20
Reflectorless EDM 62
Replacing battery 24
Resolution 49
Responsibilities 74
Reticle 12
Reticle illumination 45
RL-Standard 46
RL-Track 46
RL: reflectorless 96

S
Safety directions 72
Sdist 40
Sector beep 43
Set Hz-angle 38
Set Hz-angle direction 38
Set Hz-angle to 0°00'00" 38
Setting up the Tripod 27
Settings 42
Shift 16
Slope % 39
Software versions 52
Standing axis 11
Standing axis inclination 12
Stopbits 53
Storage 65, 66
Symbols 16
System information 50
System settings 43

T
Technical data 92
Technical terms 11
Telescope 92

Telescope focusing ring 10
Temperature range 94
Tie Distance application 40
Tilt correction 48, 51
Tilting axis 11
Tilting axis height 93
Tracking mode 33
Transport 65
Tribrach removable 93
Tribrach shiftable 93
Tripod 60
Type of tribrach 93

U
Unit settings 49
Unpacking 22
User entries 20

V
V-angle setting 39
V-Index 55
Vertical angle 11
Vertical circle 11
Vertical drive 10
Vertical index error 55
Visible laser 83

W
Warnings 68
Weight 94

Z
Zenith 12, 39
Zenith angle 11

Leica Geosystems AG, Heerbrugg, Switzerland, has been certified as being equipped with a quality system which meets the International Standards of Quality Management and Quality Systems (ISO standard 9001) and Environmental Management Systems (ISO standard 14001).

Total Quality Management- Our commitment to total customer satisfaction

Ask your local Leica Geosystems agent for more information about our TQM program

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